CHAPTER THREE

Lobstering in Gloucester Harbor: Distribution, Relative Abundance, and Population Characteristics of American Lobster (*Homarus americanus*)

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ABSTRACT

Fishing patterns and population characteristics of the American lobster were examined in Gloucester Harbor. A commercial lobsterman was contracted to collect lobster, using standard lobster gear, in Gloucester Harbor from June 1998 to May 1999. Otter trawl and scuba surveys supplemented the lobsterman survey. Fishing effort centered around Tenpound Island, Paint Factory Channel, Blynman Canal (Annisquam River), and the North Channel in the inner harbor. The harbor catch rates of legal-size lobster (0.8 ± 0.1 CTH_3) were comparable to Massachusetts-wide and Cape Ann assessments. Lobster were collected from June to November 1998 and April and May 1999 (peak catches from June to September), and no lobster were captured during the otter trawl sampling in winter. Relative abundance and length characteristics were variable throughout the harbor. Inner harbor samples yielded higher catch rates of total (3.7 ± 0.5 CTH_3) and legal-size lobster (2.7 ± 0.4 CTH_3) compared to outer harbor waters. Distinct spatial patterns of fishing effort allowed the grouping of samples into five sub-areas. The Inner Harbor sub-area mean carapace length (87.5 ± 0.3 mm) was larger, including larger male and female lobster, than all sub-areas. Lobster length in outer harbor sub-areas was truncated at 83 mm CL (harvestable size limit). Male-to-female ratio was higher in the Inner Harbor and Paint Factory Channel, and a higher percentage of ovigerous females and fewer injured lobster were observed in the Inner Harbor and Annisquam River. The study showed differences in population characteristics between the inner and outer harbor, and identified specific areas targeted by commercial lobster harvest.

INTRODUCTION

The harvest of American lobster (*Homarus americanus*) represents the most valuable single-species fishery in Massachusetts waters (Pava et al. 1998). The waters within and surrounding Gloucester Harbor and Cape Ann support an active inshore lobstering fleet (218 active permits, including territorial and offshore fishermen, landing 915,109 pounds in territorial waters during 1998) and recreational fishery (38% of state-wide seasonal landings) (Pava et al. 1998). Lobster is extensively researched (see Phillips et al. 1980 for review), and studies continue because of the ecologic and economic importance and potential anthropogenic impacts to lobster and lobster habitat.

Factor (1995) describes the life history of the American lobster. American lobster is a benthic marine decapod crustacean, widely distributed over the continental shelf of the western North Atlantic. Lobster distribution ranges from Labrador to Virginia in nearshore waters and from Georges Bank to North Carolina in deep waters, inhabiting water depth of 700 meters to the intertidal zone. The lobster population is most abundant within the coastal

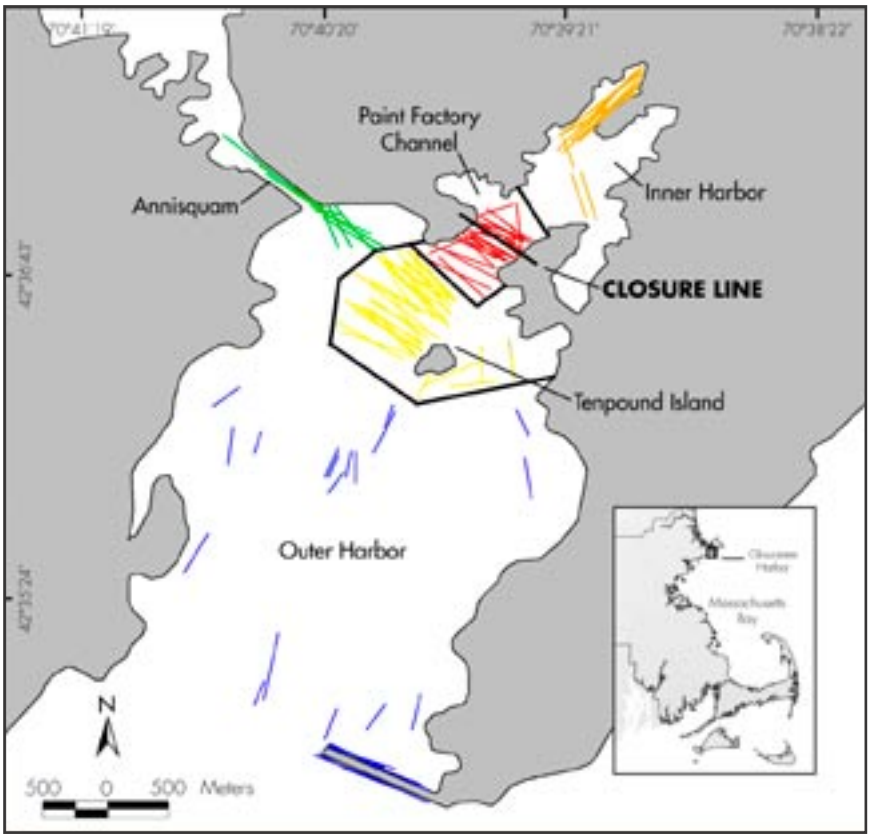

FIGURE 3.1 Lobster trawl locations for the June-November 1998 and May 1999 surveys. Sub-areas are identified by different colors and were used to investigate spatial features. Approximate location of fishing closure line identified.

waters of the Gulf of Maine, New Brunswick, and Nova Scotia. The United States distribution is concentrated in coastal waters (to 40 m) from Maine to Massachusetts.

Gloucester Harbor is an urban port with an active fishery, presenting an interesting environment to study lobster. Recent studies describe lobster behavior in Gulf of Maine coastal waters (e.g., Estrella and Morrissey 1997; Watson et al. 1999; Short et al. 2001), and the Massachusetts Division of Marine Fisheries conducts statewide monitoring of lobster stocks (Estrella and Glenn 1999). The identification of lobster fishing patterns are lacking, and few embayment-specific studies document population structure of lobster in Massachusetts, particularly in waters heavily influenced by human activities. Impacts of coastal urbanization and pollution to lobster harvesting, population structure, and behavior is not thoroughly described and warrants further study. The understanding of human perturbations, including harvesting and pollution effects, requires fundamental information on valuable fishing grounds and lobster biology to evaluate the influence and magnitude of human impacts. This study examines local fishing patterns by monitoring the catch of a commercial lobsterman and investigates seasonal and spatial population characteristics of lobster in Gloucester Harbor.

Materials and Methods

During the development of the Massachusetts Dredged Material Management Plan (MCZM 2001), American lobster was studied to provide basic lobster biological attributes and describe fishing areas in Gloucester Harbor. Information was obtained to compare the environmental suitability of in-water dredged material disposal options. The focus of this study is to examine the population characteristics and fishing activity of lobster in Gloucester Harbor.

Study Area

Gloucester Harbor is an embayment in northwestern Massachusetts Bay, characterized by an urbanized inner harbor and less-developed outer harbor. The inner harbor is a traditional working waterfront with substantial port and navigation infrastructure that supports a range of maritime industries (e.g., commercial fisheries, marine transportation and trade, fish processing, and vessel maintenance operations). Lobster fishing is intense from March to November along the Gloucester shoreline, including harbor and open coastal waters. The harvest of lobster is prohibited in the inner harbor (closure line is from Cape Pond Ice on Fort Point to a point on Rocky Neck – see Figure 3.1) for several reasons, including the maintenance of a safe navigation channel. The inner harbor is armored by man-made structures, and the outer harbor coastline is a range of boulder outcrops and beaches. The seafloor is predominantly unconsolidated, soft sediment with several areas of ledge, except for the western shore that is rocky (NAI 1999a; Valente et al. 1999; USGS 2000; SAIC 2001; Malkoski personal communication).

Commercial Lobsterman Sampling

Standard commercial lobster gear (i.e., wire mesh traps) was deployed and sampled bimonthly from June to November 1998 and May 1999 (14 sample periods; 116 trawls; 2091 pots). Lobster trawls consisted of 5 to 20 baited traps and were distributed throughout the harbor (Figure 3.1). Approximately 150 traps were set each sampling event. The lobsterman was directed to fish at least one trawl per sampling period in the inner harbor. Regions of the harbor actively fished by commercial lobstermen were sampled with the remaining trawls. The inner harbor sampling was important to study design because this area is closed to the harvest of lobster through town ordinance.

Data, consisting of carapace length (CL) (mm), sex, reproductive condition, and pathological observation, were gathered for each trawl (NAI 1999b). Lobster trawl tract location was documented using Differential Geographic Position System (DGPS) and plotted with Geographic Information System (GIS) software (ArcView). Catch per unit effort was calculated as catch per trap per three set-over days (CTH_3) (i.e., gear in the water for three days) for the lobster potting data and is interpreted as relative abundance. Catch rates were analyzed for the inner harbor, outer harbor, and harbor-wide. Adolescent and adult lobster (> 50 mm CL) are effectively sampled by lobster gear. Length categories were classified according to lobster fishery regulations. The analyses distinguished between sub-legal (< 83 mm CL), legal (≥ 83 mm CL), and total lobster (sub-legal and legal combined). Descriptive statistics are used to describe the catch data and spatial features of the collections.

Spatial Assessment

Differences in catch rates between the inner and outer harbor and identifiable spatial patterns of fishing effort resulted in more detailed spatial examination of harbor characteristics of lobster population structure. The harbor-wide data were divided into four sub-areas in the outer harbor and one sub-area in the inner harbor (Figure 3.1). Area comparison was unplanned, and there was unequal fishing effort distributed across the sub-areas. The sub-areas were identified in GIS by detecting geographic clusters of fishing effort throughout the sampling regime and were not identified before the survey. The sub-areas include Inner Harbor (IH - 15 trawls, 330 pots), Paint Factory Channel (PFC - 28 trawls, 469 pots), Tenpound Island (TI - 32 trawls, 608 pots), Annisquam River (AR - 11 trawls, 191 pots) and Outer Harbor (OH - 30 trawls, 493 pots). The sub-areas are identified by capital letters throughout the study. The IH sub-area is the same throughout the study. Catch rates, life history characteristics, and pathological condition were examined for the sub-areas.

Otter Trawl and Scuba Transect Surveys

The otter trawl survey, designed to examine the juvenile fish and crab community in Gloucester Harbor, and scuba observation provided supplemental information on the distribution and abundance of lobster. Four otter trawl stations, located in the Inner Harbor, Western Harbor, Southeast Harbor, and Outer Harbor, were sampled for 12 months (18 sample periods). Otter trawl length was standardized to 400 m (catch per unit effort [CPUE] = #/400m). Otter trawl collections were separately analyzed from the lobsterman survey to further describe seasonal and spatial features in Gloucester Harbor (NAI 1999b). Scuba transects targeted areas in the inner and outer harbor on 21 October 1999 during daylight. Ten metered transects were located in the IH, PFC, and TI sub-areas, totaling 3450 linear meters. Divers

swam the length of each transect and noted substrate type and recorded the number of lobster and biotic features. Counts of lobsters were totaled for transect length (NAI 1999a).

RESULTS

Lobster Fishing Patterns

The distribution of lobster pots described the fishing pattern of the commercial lobsterman (Figure 3.1). Fishing effort was focused around TI (29.1% of total pots fished) and the PFC (22.4% of total pots fished). A cluster occurred near the Blynman Canal (AR sub-area = 9.1%). Effort was dispersed throughout the OH (23.6%). The majority of effort within the targeted IH was in the North Channel (15.8%). The clusters of fishing effort were used to identify the sub-areas. Seasonal effort was relatively equal among the sub-areas, except for limited AR sampling during the fall (September-November).

Harbor and Seasonal Relative Abundance

The lobsterman collected a total of 4,208 lobster for the study period, and 340 lobster were obtained by the otter trawl survey. Total relative abundance was 2.0 ± 0.2 CTH_3 (study mean CTH_3 ± standard error) for the entire harbor (Table 3.1); 54.8% were sub-legal (< 83mm CL) and 45.2% were legal (> 83mm CL). Distinct spatial patterns emerged from lobster catch data between the inner and outer harbor. The total catch of lobsters was greater in the inner harbor (3.7 ± 0.5 CTH_3) compared to the outer harbor (1.7 ± 0.2 CTH_3), with substantially higher catches of legal lobsters in the inner harbor (2.7 ± 0.4 CTH_3) compared with the outer harbor catches (0.5 ± 0.04 CTH_3). Catch rates for sub-legal lobsters were analogous among inner (1.0 ± 0.1 CTH_3) and outer (1.1 ± 0.1 CTH_3) harbor waters for the study with diminutive seasonal differences observed between the areas.

Harbor-wide data were pooled to describe seasonal abundance. The catch of sub-legal lobster was higher than legal lobster from June to the beginning of October 1998. Legal lobster catch was greater from mid-October to the end of November 1998 and May 1999 (Figure 3.2). Catch of sub-legals ranged from 0.4 CTH_3 (May 1999) to 1.9 CTH_3 (September 1998). Legal catches ranged from 0.6 CTH_3 (October 1998 and May 1999) to 1.3 CTH_3 (September 1998). Overall, the total catch of lobster was highest from June to the end of September, peaking in mid-September (3.2 CTH_3). CTH_3 for both legal and sub-legal lobsters was highest in September 1998.

TABLE 3.1 Lobster catch (catch per trap per three set over days [CTH_3]) for all legal (≥83 mm carapace length), sub-legal (<83 mm carapace length), and total lobsters collected in Gloucester Harbor during June - November 1998 and May 1999. Means (SE) included where relevant.

	Annual Mean CTH_3		
Area	Sub-Legal	Legal	Total
Gloucester	1.1 (0.1)	0.8 (0.1)	2.0 (0.2)
Inner Harbor	1.0 (0.1)	2.7 (0.3)	3.7 (0.4)
Outer Harbor	1.1 (0.1)	0.5 (0.04)	1.7 (0.2)

Otter Trawl and Scuba Transect Surveys

Although the otter trawl survey was not specifically designed to harvest lobster, samples demonstrated seasonal and spatial features of lobster abundance

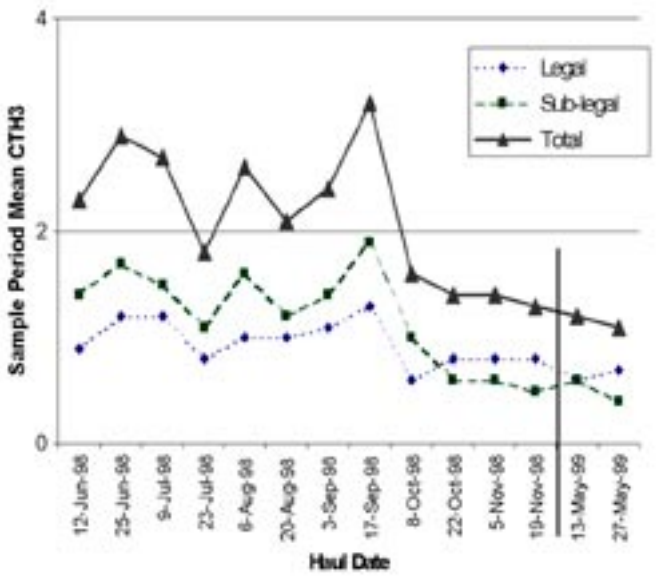

FIGURE 3.2 Catch per trap per three set-over days (CTH_3) for all lobster (total), legal, and sub-legal lobster during June-November 1998 and May 1999.

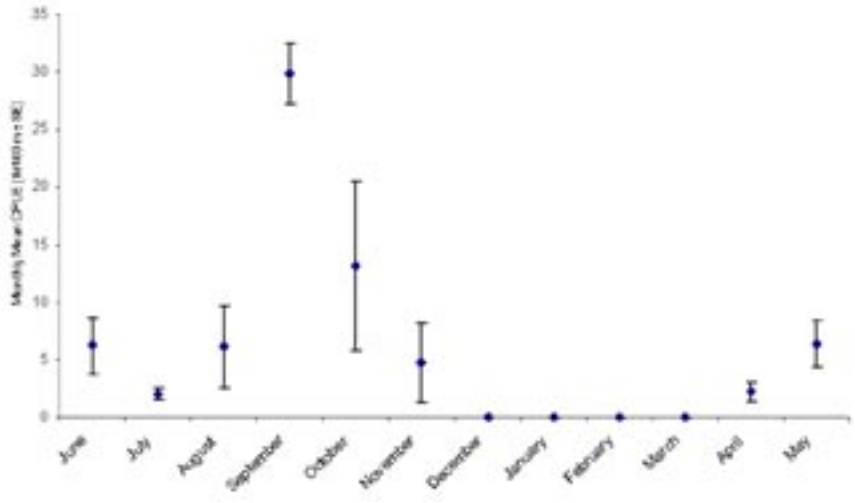

FIGURE 3.3 Seasonal collections (#/400 m; monthly mean ± standard error) of lobster from otter trawl survey, June 1998 to May 1999.

and supplemented the lobsterman data. The Inner Harbor otter trawl station presented the highest annual CPUE and variability (study mean ± standard error; 19.9 ± 7.5 / 400 m), and collections were substantially greater than other otter trawl stations. The Western Harbor station (near the mouth of the Blynman Canal) illustrated the second highest catch (4.5 ± 1.3 / 400 m), and the Southeast and Outer Harbor stations were similar (2.4 ± 0.9 / 400 m and 1.8 ± 0.6 / 400 m, respectively). Scuba transects located in the PFC (three transects totaling 1,100 linear m) demonstrated the highest density of lobster (0.16 lobster / linear m). Five transects were searched in the IH (1,300 linear meters), finding 0.13 lobsters / linear m. TI transects, surveying 1,050 linear m, yielded the lowest lobster density (0.08 lobster / linear m).

Seasonal abundance observed during the otter trawl sampling appeared similar to the lobster potting data (Figure 3.3). Lobster were collected from June to November 1998 and April and May 1999. The catches ranged from 2.1 ± 0.6 / 400 m (July) to 29.9 ± 2.6 / 400 m (September), peaking in September and October. The high abundance in September and October was dominated by large catches at the Inner Harbor station (total [N] = 180 and 64, respectively). No lobster were caught from December to March.

Sub-Area Examination and Population Structure

Total catches (study average CTH_3) were substantially different among the sub-areas (Table 3.2). Catches were largest in IH, and PFC (2.1 ± 0.3 CTH_3) was relatively higher than other sub-areas (Figure 3.4). The IH sub-area demonstrated considerably greater numbers of legal-size lobster. PFC sub-legal lobster catches were slightly larger than other sub-areas. Catches of sub-legal lobster were comparable among other sub-areas (Table 3.2).

Length frequency distribution assessed size of lobsters collected by the lobsterman (efficiency of lobster gear is biased toward larger lobster; 99.5% of catch was > 50 mm CL) (Figure 3.5). Harbor-wide length ranged from 30 to 130 mm CL. The majority of lobsters collected during the lobsterman sampling were between the 70 to 99 mm size classes (60% of total catch), averaging 81.0 ± 0.2 mm CL (mean CL ± SE). Lobster collected in the IH sub-area (87.5 ± 0.3 mm) were larger than all other sub-areas (Table 3.2). Nearly 50% of the legal lobster collected during the study were caught in the IH. IH also presented the largest size range (30 – 130 mm CL). The otter trawl collected notable numbers sub-legal lobster in the study area (mean CL ± SE of total [N] = 60.7 ± 0.6 mm CL), especially at the Inner Harbor station.

TABLE 3.2 Sub-area lobster catches of total, legal, and sub-legal lobster, average carapace length, male:female ratio, percent of ovigerous, and percent of missing claw in Gloucester Harbor during June - November 1998 and May 1999. Means (SE) included where relevant.

Statistic	IH	PFC	AR	TI	OH	Study Average
Catch Data						
Total CTH_3	3.7 (0.5)	2.1 (0.3)	1.4 (0.3)	1.4 (0.2)	1.8 (0.2)	2.0 (0.2)
Legal lobster CTH_3	2.7 (0.4)	0.6 (0.1)	0.5 (0.2)	0.4 (0.1)	0.6 (0.1)	0.8 (0.1)
Sub-legal lobster CTH_3	1.0 (0.1)	1.5 (0.2)	0.9 (0.1)	1.0 (0.1)	1.2 (0.2)	1.2 (0.1)
Length						
Total mean CL	87.5 (0.3)	75.9 (0.4)	79.1 (0.7)	77.1 (0.4)	81.3 (0.4)	81.0 (0.2)
Male mean CL	89.5 (0.4)	77.0 (0.5)	80.1 (0.9)	78.4 (0.5)	82.2 (0.6)	82.4 (0.3)
Female mean CL	84.6 (0.5)	74.2 (0.6)	77.7 (0.9)	75.6 (0.6)	80.3 (0.4)	79.1 (0.3)
Condition						
Male : female ratio	1.5	1.6	1.3	1.2	1.2	1.4
% Ovigerous	14.1	5.5	12.0	8.3	11.4	10.4
% Missing claw	7.3	16.9	9.6	14.9	12.9	12.2

Size distribution generally overlapped among the PFC, TI, AR and OH sub-areas, and IH was unique. The mean CL (mm) (± SE) of OH (81.3 ± 0.4), AR (79.1 ± 0.7), TI (77.1 ± 0.4), and PFC (75.9 ± 0.4) was below legal size (Table 3.2), and length frequency were truncated at the legal size limit. The higher catch rates of legal lobsters at IH produced the reverse trend (Figure 3.5).

Male lobster were larger than female lobster (Table 3.2). This trend was apparent in all sub-areas. The largest male and female lobster were found in IH (mean CL = 89.5 mm and 84.6 mm , respectively). PFC was characterized by the smallest male (77.0 mm CL) and female (74.2 mm CL). The male-to-female ratio was 1.4, with the highest ratio found at PFC (1.6) and IH (1.5) and lowest in the OH (1.2) (Table 3.2). Percentage of ovigerous lobster for the study was 10.4%. The IH percentage of ovigerous lobster (14.1%) was higher than other

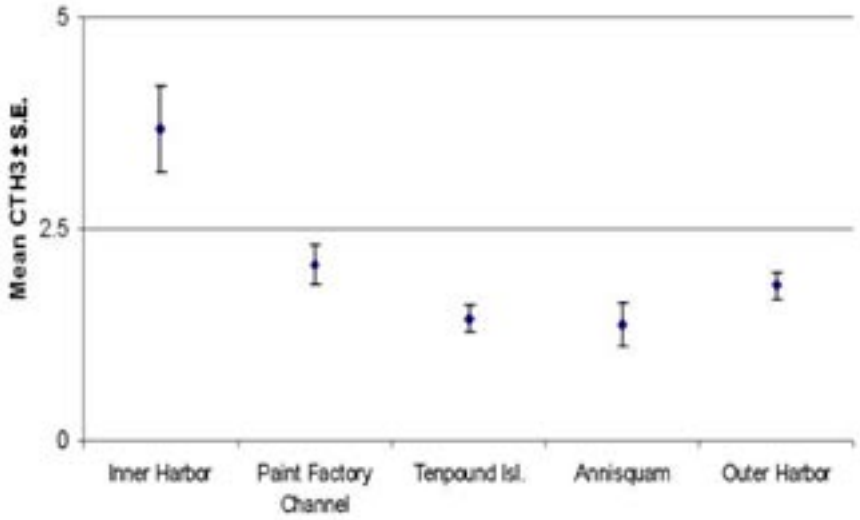

FIGURE 3.4 Total mean catch per trap per three day haul (CTH_3) (± standard error)—legal and sub-legal lobster combined—for sub-areas in Gloucester Harbor, June-November 1998 and May 1999.

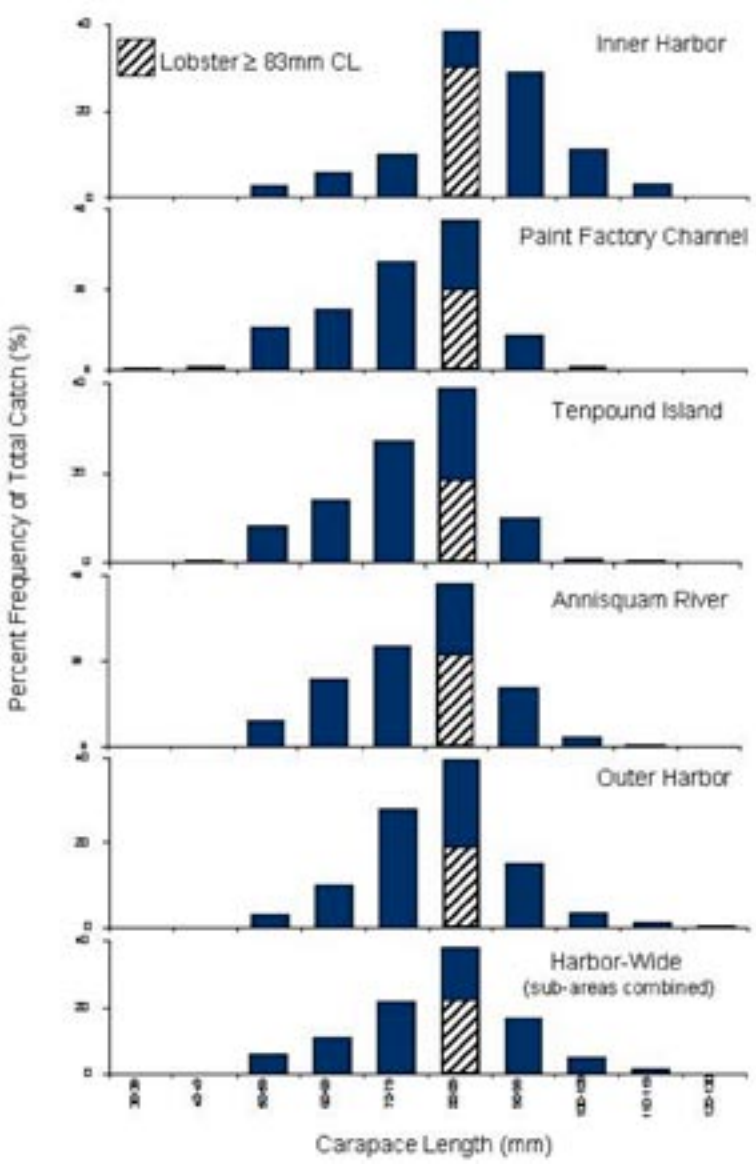

FIGURE 3.5 Length-frequency from sampling during June-November 1998 and May 1999 in Gloucester Harbor and sub-areas. Hatched bar indicates lobster ≥83 mm CL in 80-89 size class.

sub-areas, and AR percentage (12.0%) was notable (Table 3.2). PFC, TI, and OH presented the highest percentage of injured lobster (missing claw), while IH the lowest (Table 3.2).

DISCUSSION

Wheeler and Hughes (1957) [reviewed by Jerome et al. (1969)] described the state waters surrounding Essex County (waters including Gloucester Harbor and Cape Ann) as exemplary fishing grounds. Gloucester Harbor and adjacent waters sustain a substantial portion of Massachusetts coastal lobster population and fishing activity (Estrella and Glenn 1999). This study and systematic statewide resource monitoring (Estrella and Glenn 1999; Pava et al. 1998) illustrate that productive lobster habitat and lobster fishing continues to flourish in Gloucester Harbor.

The index of lobster fishing obtained in this study is the result of one lobsterman. Acknowledging the occurrence of other fishermen and fishing areas in Gloucester Harbor, the pattern of fishing described in this study may underestimate the extent of important fishing grounds. Commercial fishermen, however, are concerned with maximizing harvest of lobster (Lawton et al. 1984b), and this study identifies important fishing grounds in Gloucester Harbor that were not described prior to the study. Clusters of fishing effort were found in specific areas of the harbor, including PFC, TI, and AR, and scattered throughout the OH. The geographic coverage was used as evidence of important fishing grounds.

Estrella and Glenn (1999) present 1998 Massachusetts lobster assessment data, and identify that Cape Ann waters produced slightly higher catch rates of legal-size lobster and similar catches of sub-legal lobster compared to state-wide data. Catch rates during this study indicated comparable or higher harbor-wide catch rates of legal-size lobster and sub-legal lobster (using catch per trap haul – Estrella and Glenn 1999). Legal-size lobster catch rates were heavily influenced from collections in the inner harbor.

The largest catches (interpreted as the period of highest relative abundance) occurred during the summer

and early fall. The reduction in catch of sub-legal lobster and subsequent increased catch of legal lobster from October to November 1998 indicated the onset of molting and recruitment of lobster to the fishery. Lobster abundance throughout Gloucester Harbor diminished in November. Resident lobster populations exist in nearshore waters of the Gulf of Maine (Heinig 1998; Watson et al. 1999; Short et al. 2001). However, winter scuba (Malkoski personal communication) and otter trawl (NAI 1999b) surveys confirmed the low abundance of lobster in Gloucester Harbor and were corroborated by the relative lack of commercial fishing during this time period. Seasonal occurrence of lobster during this study support that lobster travel inshore in the spring and return to offshore waters in late autumn (Lawton et al. 1984a; Estrella and Morrisey 1997; Watson et al. 1999).

Spatial variability within Gloucester Harbor was evident, demonstrated by substantially higher catches of legal-size lobster in the inner harbor (IH sub-area) and lower catches in the outer harbor (including the PFC, TI, AR and OH sub-areas). IH catches were considerably higher than harbor-wide, Cape Ann, and statewide data. Difference in catch is partially reflective of abundance, since fishing effort influences catches. Intense trap saturation (i.e., number of traps fishing) decreases catches, and outer harbor waters are heavily fished compared to the inner harbor (which is closed to commercial harvest). The otter trawl and scuba surveys reinforced the trend of higher lobster abundance in the inner harbor. Otter trawl collections and scuba observations at the IH and PFC stations demonstrated concentrated lobster use of the inner harbor.

Harvesting effort and conceivably habitat conditions, including water temperature and organic load in seafloor sediments, influenced inner harbor relative abundance. Studies (e.g., Crossin et al. 1998; Watson et al. 1999) found lobster move to warmer waters to enhance growth. Inner harbor waters were warmer [bottom water temperature average was ~2°C higher than outer harbor stations from June to October 1998 (NAI 1999b)], primarily due to reduced tidal flushing in the inner harbor with deeper harbor and offshore waters, and may present preferable environmental conditions for lobster growth. Fish processing plants directly discharged fish waste to the harbor for decades (Whitman and Howard 1958), and marine sediments continue to present evidence of organic loading (Valente et al. 1999). Adult and juvenile lobster may be attracted to the organic content found in inner harbor sediments.

Commercial lobster gear is an effective method to collect adolescent and adult lobster, and studies using lobster traps demonstrate lobster size equal to / or below the minimum legal size limit (Lawton et al. 1984a; Estrella and Glenn 1999). Harbor-wide length distribution was truncated at the minimum legal size (83 mm CL), but notable differences in size were obvious between the inner and outer harbor waters. Smaller lobster were found and length frequency was truncated at the minimum legal size (i.e., 83 mm CL) in outer harbor sub-areas (i.e., PFC, TI, AR, and OH). The IH length class illustrated a higher proportion of legal-size lobster, resulting in larger average size. Commercial exploitation apparently limits the size range of lobster and is typical of heavily exploited areas.

Male-to-female sex ratio (1.4) identified that more males inhabited Gloucester Harbor than females, and male lobster were larger than female lobster throughout the harbor. Male lobster mature earlier than female lobster, but male lobster must be larger than mates for successful fertilization and to protect females from other males (Aiken and Waddy 1980). The highest male-to-female sex ratios were found in IH and PFC.

The highest percent of ovigerous lobster were found in the IH and the AR sub-area (surrounding the channel connecting the Annisquam River and harbor waters). Higher presence of ovigerous lobster in the IH and AR may indicate female lobster were seeking an optimal water temperature regime to improve egg development (Cooper and Uzmann 1971).

The occurrence of injured lobster in the outer harbor (OH, TI, and PFC) provided evidence of harvesting. Fewer injured lobster were collected in the IH sub-area. Intense fishing effort results in lobster frequently caught and handled which increases chance of being injured.

This study describes seasonal and harbor characteristics of lobster in Gloucester Harbor during 1998-

1999. We assume that commercial fishermen fish in productive areas, and the distribution of lobstering effort demonstrated important fishing grounds in Gloucester waters. Although Gloucester Harbor is a traditional urban harbor, influenced by centuries of human perturbations, harbor waters support a productive lobster population and fishery. The influence of harvesting was apparent during the study.

The inner harbor is closed to lobster fishing, and the lack of fishing effort affects the catch and population characteristics of lobster. It is impossible to evaluate the influence of the inner harbor closed area to the lobster population, and this study did not examine lobster movement throughout the study area (i.e., inner harbor immigration and emigration). Results suggest that inner harbor waters provide refuge from fishing pressure and may assist in supporting a heavily exploited outer harbor. Targeted research to examine the function of closed areas on lobster populations is required to confirm study observations.

Closed areas, also known as marine protected areas or marine refugia, are gaining popularity as means to conserve marine biological diversity and improve fishery productivity (e.g., Johnson et al. 1999; Murawski et al. 2000). The situation in Gloucester Harbor is unique to closed area approaches. Areas closed for protection of marine resources are normally "pristine" environments. The inner harbor is not pristine but relatively degraded (MCZM 2001). Factors contributing to the elevated catches and larger size in the inner harbor include reduced fishing pressure, productive lobster habitat quality, and/or a combination of these reasons.

The identification of fishing areas in coastal waters is required to improve resource management decisions, and the utility of closed areas for marine conservation and fishery enhancement warrants targeted research. The influence of urbanization and environmental degradation to marine and fisheries resources is largely unknown. This study found that lobster are tolerant to degraded conditions. It is important, however, to understand the ecological effects of human perturbations to lobster populations, harvesting practices, and environmental integrity to completely understand the implications of pollution input and coastal alteration projects.

Acknowledgments

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APPENDIX Gloucester Harbor lobster survey results (catch per trap per three set over days [CTH_3]) for each sampling date (NAI 1999b).

Region	6/12 1998	6/25 1998	7/9 1998	7/23 1998	8/6 1998	8/20 1998	9/3 1998	9/17 1998	10/8 1998	10/22 1998	11/5 1998	11/19 1998	5/13 1999	5/27 1999	Annual Mean (CTH3)	Standard Error (±)
Inner																
Legal	3.2	3.8	3.0	3.6	4.2	3.3	4.0	4.0	1.6	2.8	2.6	1.5	1.4	1.8	2.9	0.3
Sub-legal	1.8	1.1	1.9	1.4	1.3	0.7	1.3	1.5	1.2	0.5	1.0	0.4	0.3	0.5	1.1	0.1
Total	5.0	4.9	4.9	5.0	5.5	4.0	5.4	5.6	2.7	3.4	3.6	1.9	1.7	2.3	4.0	0.4
Outer																
Legal	0.5	0.7	0.8	0.2	0.4	0.5	0.5	0.7	0.4	0.4	0.5	0.6	0.4	0.3	0.5	0.04
Sub-legal	1.3	1.8	1.4	1.0	1.7	1.3	1.4	2.0	1.0	0.6	0.5	0.5	0.7	0.4	1.1	0.1
Total	1.8	2.5	2.3	1.2	2.1	1.8	1.9	2.7	1.4	1.0	1.0	1.1	1.1	0.7	1.6	0.2
Harbor-wide																
Legal	0.9	1.2	1.2	0.8	1.0	1.0	1.1	1.3	0.6	0.8	0.8	0.8	0.6	0.7	0.9	0.1
Sub-legal	1.4	1.7	1.5	1.1	1.6	1.2	1.4	1.9	1.0	0.6	0.6	0.5	0.6	0.4	1.1	0.1
Total	2.3	2.9	2.7	1.8	2.6	2.1	2.4	3.2	1.6	1.4	1.4	1.3	1.2	1.1	2.0	0.2